Programme of "NUMERICAL METHODS AND MODELS in ENGINEERING".		
• **Code: I0231** • **type of course unit:** compulsory for **Mechanical Engineering** • **level of course unit (e.g. first, second or third cycle; sub-level if applicable):** second cycle • **year of study:** 1RD year**, semester:** 1ND semester		
Number of ECTS credits: 6 (workload is 60 hours + work at home; 1 credit = 25 hours)		
Teacher: Pellegrino Enza		
1	**Course objectives**	Aim: to enable students to classify real-life problems and choose the best suited algorithms for dealing with them, in terms of costs/benefits and convergence properties. At the same time, the course is meant to make students well acquainted with the use of software (Matlab) and with the practical implementation of some algorithms.
2	**Course content and Learning outcomes (Dublin descriptors)**	Topics of the module include: **initial value problems for Ordinary Differential Equations (Ode)**: Classical one-step methods (convergence properties), Multistep methods (Adams' family, convergence properties), Stiff systems; **boundary value problems for Ode**: shooting methods and finite differences methods (convergence properties), methods based on the Galerkin's formulation (finite element methods); **boundary value problems for Partial Differential Equations**: finite differences methods; consistency, stability, convergence, Lax equivalence theorem; error analysis; **discrete Fourier transform** and trigonometric interpolation. On successful completion of this module, the student should - have profound knowledge of numerical discretization of objects learned in course; - have knowledge and understanding of the size of the errors involved in numerical discretization; - understand and explain the different behaviors of the numerical schemes in terms of costs / benefits and their convergence properties; Demonstrate skill to classify the problems and ability to choose the best suited algorithms for dealing with them; - demonstrate capacity for using software to calculate numerical solutions and for designing programs to implement some algorithms.
3	**Prerequisites and learning activities**	The student must know the basic notation of Matlab and the basic notation of Numerical Analysis contained in exam Calcolo Numerico.
4	**Teaching methods and language**	Lectures, exercises. **Language**: Italian **Ref. Text books** W. Gautschi: *An introduction Numerical Analysis*, Boston [etc.], Birkhauser , 1997. A. Quarteroni, A.Valli: *Numerical Approximation of Partial Differential Equations*. Springer-Verlag 1997 A. Quarteroni, R. Sacco, F. Saleri: *Matematica Numerica*. Springer-Verlag 2000 J N Reddy: *An Introduction to the Finite Element Method* McGraw-Hill Series in Mechanical Engineering, Engineering Series. McGraw-Hill, 2005 E. Santi: *Appunti delle lezioni di Metodi Numerici per l'ingegneria*
5	**Assessment methods and criteria**	**Written and oral exam.**